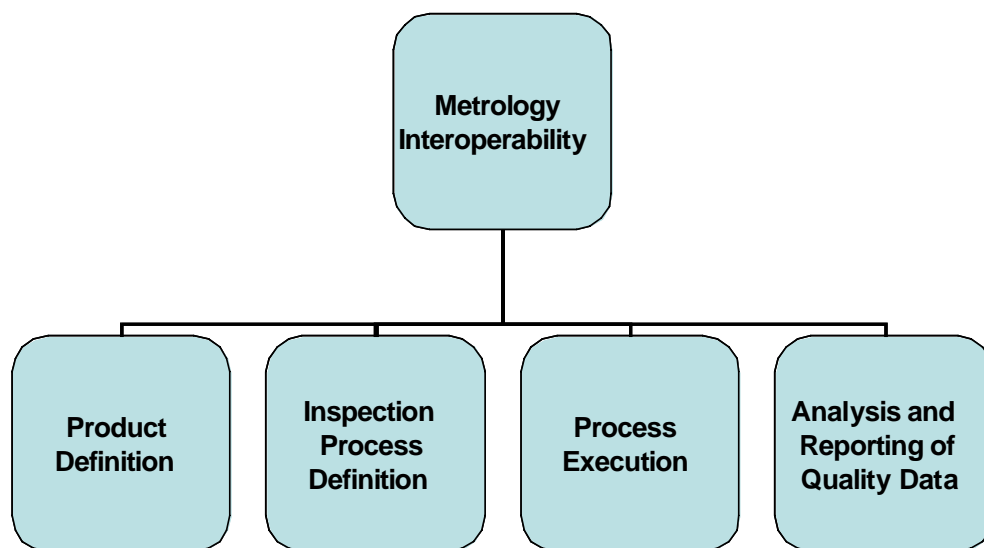


# INTERNATIONAL METROLOGY INTEROPERABILITY SUMMIT

## PRODUCT DEFINITION REPORT

**30 MARCH 2006**

**EDITOR BILL RIPPEY**



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### BREAKOUT SESSION

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#### GETTING STARTED

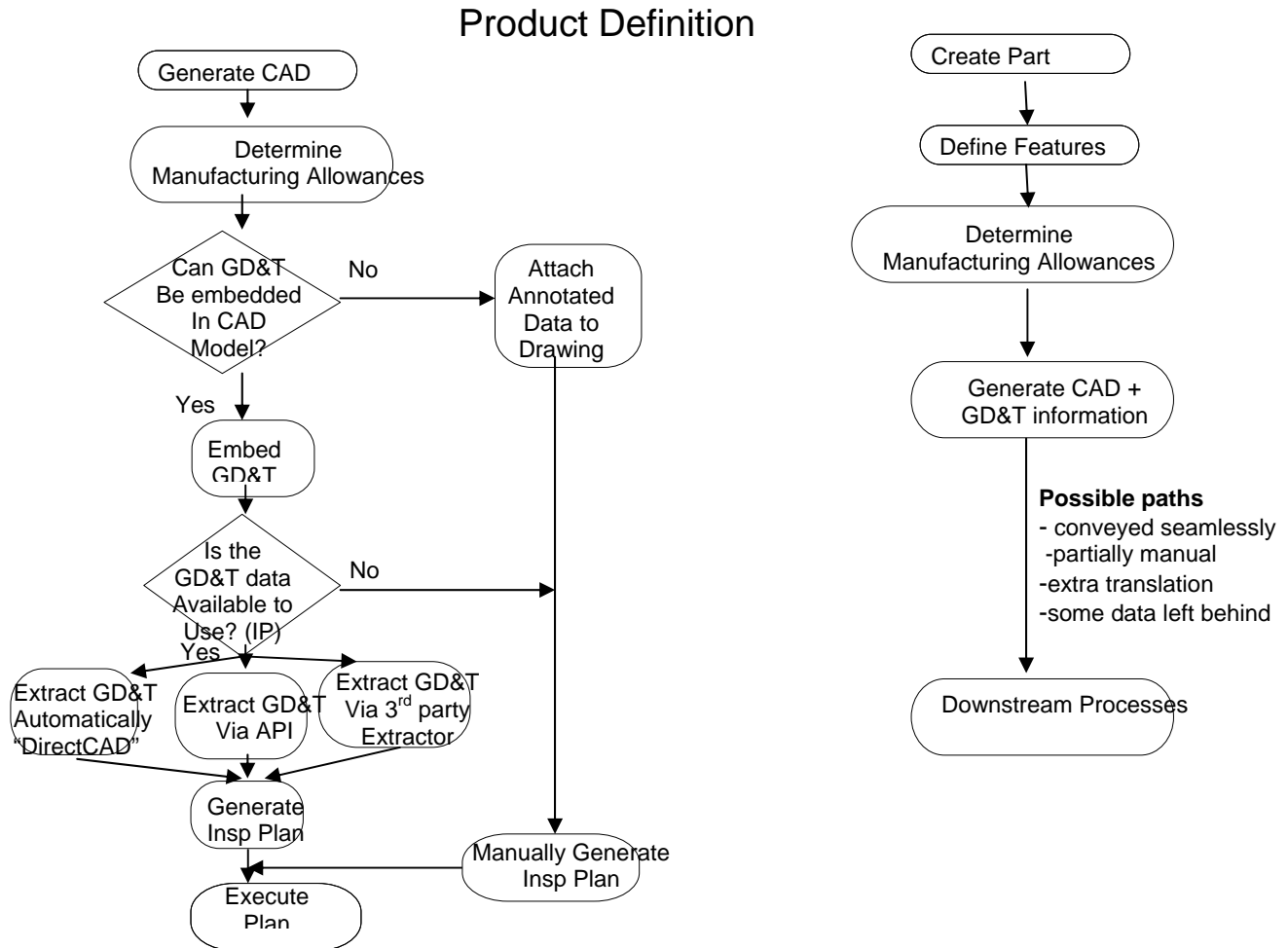
##### Participant Introductions:

- |                     |                       |
|---------------------|-----------------------|
| • Stephen Andersson | Renishaw              |
| • Conrad Bock       | NIST                  |
| • Dave Callaghan    | IQL                   |
| • Tom Kramer        | NIST - session scribe |
| • Kevin Legacy      | Zeiss                 |

- Len Slovensky Northrup Grumman
- Tom Melson Boeing
- Andrew Moore QVI
- Troy Niehaus Metronor
- Bill Rippey NIST - session leader
- Bill Tandler Multi Metrics, Inc
- Jerry Udy Spatial
- 
- Area of Expertise
- What are your “hot buttons”

## ACTIVITY DIAGRAM

1. Create an Activity Diagram for your topic area. An example is shown below.



**Use Viseo or PowerPoint to create/edit your diagram**

2. From the activity diagram, define key functions that should be addressed:

**Note:** The draft activity diagrams define few key functions. If they are complete, that is fine, but be sure that all key functions in your topic area are identified. List the key functions here.

**Function: Convey CAD data to Downstream processes**

**Issue:** CAD data (including GD&T) does not flow seamlessly to downstream processes. **Solution1.** Pursue an api-based solution like AIMS. Boeing gives away

the “kernel” software, publishes the “api specification”. **SolutionPriority: Action:**  
**Solution2:** pursue a standard data format. **Action:**

**Issue:** CAD data format is not compatible with Inspection Planner. Requires: buy new CAD, or buy new Inspection Planner, or translate the data. **Solution:**  
**SolutionPriority: Action:**

**Issue:** Buying a new CAD system that produces data compatible with inspection planning leaves a user vulnerable to changes in the future, restricts choice of products to use downstream. **Solution: SolutionPriority: Action:**

**Issue:** When a standard is used, there is often no certification of products that they conform to the standard. **Solution: SolutionPriority: Action:**

**Issue:** a standard format may “lose” or not provide for conveying vendor-specific proprietary data. This can hurt the user and discourage vendors from improving their products. **Solution: SolutionPriority: Action:**

**Issue:** For the family of STEP standards, the QA performance testing of the multiple AP’s requires great effort. **Solution:** develop a strategy for streamlining testing of the APs. **SolutionPriority: Action:**

#### **Function: convey GD&T data to Inspection Planning**

**Issue:** data format is not compatible with Inspection Planner. Requires: buy new CAD, or buy new Inspection Planner, or translate the data, or manually re-enter the GD&T data through the Inspection Planner. **Solution: SolutionPriority: Action:**

**Issue:** CAD data does not contain the GD&T data. Requires: manually entering GD&T data at the Inspection Planner, or at some other level of “drawings”. **Solution: SolutionPriority: Action:**

**Issue:** GD&T data not embedded in the CAD model makes it impossible to control the inspection process planning. If data is expressed as annotations in CAD files, or as notes on drawings it is not available to automated computer processes that can use it. **Solution: SolutionPriority: Action:**

**Issue:** GD&T data attached to CAD data as annotation must be processed by a human being, cannot be processed by a computer process. **Solution: SolutionPriority: Action:**

#### **Function: convey GD&T data to Manufacturing Planning**

**Issue: Solution: SolutionPriority: Action:**

#### **Function: convey GD&T data to Analysis**

**Issue: Solution: SolutionPriority: Action:**

**Barriers:**

**Function: participation of vendors in standards development**

- **Issue:** there aren't enough vendors participating to gain consensus and attain a standard/standards.

**Solution:**      **SolutionPriority:**      **Action:**

**Barriers:**

**Function: participation of users in standards development**

**Issue:** there aren't enough strong, unified user support to "demand" standards and define common needs.      **Solution:**      **SolutionPriority:**      **Action:**

**Barriers:**

## **CURRENT STATE ASSESSMENT**

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**Definitions:**

- **Deficiencies** – Activities where a lack of interoperability causes "pain". Quantify the pain to the best level possible.
- **Barriers** – Obstacles that stand in the way of achieving interoperability – barriers to overcoming the deficiencies.
- **Emerging best practices** – What is being done today that is eliminating the "pain" and overcoming barriers? Try to capture as much content about the best practice as is possible,

**Barriers to achieving interoperability**

## CURRENT STATE ASSESSMENT FOR PRODUCT DEFINITION

| KEY FUNCTIONS | DEFICIENCIES –<br>WHERE DOES IT<br>HURT? HOW BADLY? | BARRIERS – WHAT’S<br>IN THE WAY? | EMERGING<br>BEST PRACTICES |
|---------------|---|----------------------------------|----------------------------|
|               | •   | •                                | •                          |
|               | •   | •                                | •                          |
|               | •   | •                                | •                          |
|               | •   | •                                | •                          |

### Notes on the Current State Assessment:

Tabulate any points that arise during the current state assessment that are not part of the table here.

- More involvement from CAD vendors is needed to reach standards
- More involvement from users is needed to reach standards
- IF you can't associate GD&T data with part features you can't control the inspection plan.
- Companies can shy away from BIG PROJECTS – don't tackle all issues at once – focus on smaller issues in phases.
- The scope of CAD companies focus is expanding beyond just CAD – standards don't match their business case. We need to know their goals better.
- Vendors currently expend great effort in multiple directions trying to integrate – there are too many directions to follow all.
- Can a standard format cause loss of proprietary capability data? – may give vendors less incentive to improve capabilities.
- STEP uses a file-based approach, which often results in vendors buying tools that manipulate the files through an “api” interface. AIMS for example is a direct “api interface” approach, where at this time the user does not manipulate external files.
- Is the IMIS forum considering only open, non-proprietary specifications/standards? Is there a path for migrating “open proprietary” to “open non-proprietary”?
- What are other issues in dealing with older, “legacy” systems? E.g. impractical or impossible to upgrade them, difficult to discard working systems and their data.
- What could be the role in standards for specifications or tools based on the model of “open source code” tools and applications?
- The use of standards doesn't necessarily reduce costs of buying new software licenses. A standard will reduce this cost if the number of different products used for data translation can be reduced.
- How did the WEPROM effort get extensive user involvement? How did the I++ effort get

so much user involvement?

- There will always be costs of keeping products up with revisions in specifications.
- Out of scope issues: How can well integrated data be used to detect errors in inspection plans? To detect errors in equipment function? To detect errors in application software? To detect errors in inspection programs?

## **VISION FOR PRODUCT DEFINITION**

### **1. What is the envisioned future state for product definition?**

- Multi-process manufacturing will have traceable nominal feature data.
- Internet posting of part design data for bidding by contractors.
- Possible to derive from the design data, manufacturing sequences, fixturing plans, inspection plans, manufacturing programs.
- All standards will be harmonized.
- Existing standards will be extensible, partly through good modularization.
- There will be organization of complete product data across the product lifecycle
- No data left behind - the definitions of data interfaces will be complete and all important data will be conveyed effortlessly
- Open interface specifications are extensible
- I can choose a product vendor and not lose interoperability with my other components.
- Data will be exchanged without use of industry agreements (vendor to vendor handshake).
- Data can be archived long term without the need to preserve the applications that generated them.
- Industry-wide agreement on data formats - "everybody plays" in the standards arena.
- Interface specifications will be stable, and new needs will be addressed quickly.
- Generate DMIS automatically using standard data.

### **2. Identify the attributes of a Vision for each of the key functions.**

#### **Sample Vision for Product Definition:**

A robust complete product definition will directly provide all information needed for defining all metrology processes without the need of translation.

### **Characteristics of the Vision for Key Function 1**

- Notes
- 

### **Characteristics of the Vision for Key Function 2**

- 
- 

### **Characteristics of the Vision for Key Function 3**

- 
- 

(Continue for all key functions)

**Checkpoint:** It is important that you get the issues identified by the end of the day. Try to adjust your time schedule to be sure to do that. Don't worry about what you might not spend as much time as you would like in fleshing out. There will be input after the fact, and there will be a review and update cycle.



## ISSUES FOR PRODUCT DEFINITION

### Developing Issues:

An **Issue** is any technology void, cultural attribute, or process characteristic that impedes progress or is a barrier to the optimal successful execution of the subject function. Issues may be generic, or they may apply to specific products, processes, etc.:

- Product-Specific – Issues that deals with design or performance of the topic. Ask the question; are there issues associated with a product or class of product? Are there specific issues associated with any sector or application?
- Process-Specific – Issues that deals with execution of the topic. Are there processes or activities that lead to the identification of issues? For example, inspecting large structures with laser trackers might raise different issues than a touch probe for a CMM.
- Other – Standards, Emerging Technologies, Disruptive Technologies, Infrastructure. Are there issues that fall in the catch all categories? What margining technologies could greatly change the metrology landscape? What practices (like in process certification) present issues? What emerging technologies or practices would be implemented if cultures were changes or infrastructure was not an issue?

Evaluate the work that you have done in getting to this point, and tabulate the issues. Keep in mind that the Issues may or may not align with the Key Functions, but be sure that you do tabulate all issues associated with executing the key functions. Also, remember that there are crosscutting issues that someone must address. Tabulate them separately.

Use the space below to tabulate issues, and when complete, tabulate in the table on the next page. It may be necessary to group and screen issues. All important issues should be tabulated, but be sure to keep them at a high level – this is the top of the hierarchy (at the program level).

| TOP ISSUES     |  |
|----------------|--|
| Key Function 1 | <ol style="list-style-type: none"><li>1.</li><li>2.</li><li>3.</li><li>4</li></ol> |
| Key Function 2 | <ol style="list-style-type: none"><li>1.</li><li>2.</li><li>3.</li></ol>           |
| Key Function 3 | <ol style="list-style-type: none"><li>1.</li><li>2.</li><li>3.</li><li>4</li></ol> |

## Update Activity Diagram

Copy the “as is” activity diagram and update it to reflect the vision and include, where applicable, the issues.

### **Note:**

**It is not possible to gauge pace in a roadmapping exercise. It is also variable because the richness and breadth of the topic areas are not equivalent. If you are not at exactly the “right point” at the end of the day, don’t feel badly. We’ll catch up. Try to have the issues defined.**

## Preparation of the Presentation

Transfer from this template to the Power Point template for Presentation 1, and gain group consensus on:

Your activity diagram

Key points from your current state assessment

Vision

Issues

Updated Activity Diagram (“To Be”)

## BUILDING THE ROADMAP

### DEFINING MAJOR ISSUES – SOLUTIONS AND ACTIONS

**YOU WILL NOT POPULATE THE ROADMAP IN PROCESS. THE MODEL IS SHOWN TO MAKE YOU AWARE OF THE FORM OF THE RESULT.**

| Priority                 | WBS   | Roadmap Hierarchy                  | Metric                  | FY2007            | FY2008                    | FY2009                    | FY2010                    | FY2009            |
|--------------------------|-------|------------------------------------|-------------------------|-------------------|---------------------------|---------------------------|---------------------------|-------------------|
|                          | 1     | Topic Area e.g. Product Definition |                         |                   |                           |                           |                           |                   |
|                          | 1.1   | Issue: Text                        |                         |                   |                           |                           |                           |                   |
| Future<br>Medium<br>High | 1.1.1 | Solution:<br>Text                  | Definition of<br>Metric | Maturity<br>Start | Action<br>Benefit<br>Cost | Maturity Final            |                           |                   |
|                          |       |                                    |                         |                   | Maturity Start            | Action<br>Benefit<br>Cost | Maturity<br>Final         |                   |
|                          | 1.1.2 | Solution<br>Text                   |                         |                   |                           | Maturity<br>Start         | Action<br>Benefit<br>Cost | Maturity<br>Final |

A **solution** is a critical capability that must be achieved to solve an issue. Keep in mind that parallel paths are often the best methods for assuring resolution of technical challenges, as illustrated by the following example for fuel cells:

- **Example Solution 1: Reduce variety and strictness of fuel requirements.**
  - Task 1: Determine and issue standards for challenging but attainable baseline fuel specification for use by several major classes of powered devices.
  - Task 2: Retrofit existing devices (for given major class) to use baseline fuel within two years.
- **Example Solution 2: Provide compact and flexible fuel reformer for environmentally benign field use.**
  - Task 1: Provide advanced filtration and sulfur removal system.
  - Task 2: Eliminate/minimize water requirements from fuel reformation process.

**LIST THE ISSUE AND THEN DEVELOP THE SOLUTION. THE FACILTATOR WILL HAVE TO MAKE A DETERMINATION AS TO WHETHER THERE IS TIME TO FLESH OUT SOLUTIONS AND ACTIONS. IF THERE IS, IT IS USUALLY BETTER TO DO THAT IN ONE-PASS. IF NOT, LIST THE SOLUTIONS AND COME BACK TO THE ACTIONS. IT IS PREFERABLE TO COMPLETE THE ADDITIONAL INFORMATION FOR THE SOLUTION SET THAN TO ADD ACTIONS AND FAIL TO COMPLETE.**

**ISSUE 1:**

**Solutions:**

- List Solutions Here
  - **Actions:**
    - List Here

**ISSUE 2:**

**Solutions:**

- List Solutions Here
  - **Actions:**
    - List Here

**ISSUE 3:**

**Solutions:**

- List Solutions Here
  - **Actions:**
    - List Here

## THE ISSUE ASSESSMENT

Suggested timeframes:

- 0-3 years (short)
- 4-7 yrs (medium)
- 8-12 years (long)

**ISSUE X:** Name goes here

**SOLUTION X:** Name goes here

- **Priority (H/M/F):** Enter data here
- **Duration: How long will it take** – enter data here
- **Timeframe: when does it start?** Enter data here
- **Known Dependencies: what has to be done as a prerequisite or in parallel?** Enter data here
- **Metric: What is the achievement that will be realized?** Enter data here
- **ROM Estimate (\$): How much will it cost?** Enter data here
- **Benefit: What good thing will result and by how much? Provide any information useful for a business case**
- **Change to MRL (see chart in methodology handout) – don't try to be too analytical – a subjective evaluation is fine. Record starting and ending MRL.**
- **Organizational barriers and required changes**
- **Notes:** Enter data here

## Priority Solutions

For the closing presentations, select the most important solutions from your solutions list. The maximum is 10, so, if you have more than 10, you will need to group and prioritize. Insert priority solutions into the PowerPoint template provided